JOURNAL

OF THE

WASHINGTON ACADEMY OF SCIENCES

VOL. 19 APRIL 19, 1929 No. 8

ZOOLOGY.—*The genus* Trimosina *and its relationships to other genera of the Foraminifera.*[1] JOSEPH A. CUSHMAN, Sharon, Massachusetts.

In 1907 Schubert, in a paper entitled *Beiträge zu einer natürlicheren Systematik der Foraminiferen,*[2] dealt with the relationships of *Chrysalidina* d'Orbigny and some supposedly related genera, some of which he proposed at that time. In my recent work, *Foraminifera, their classification and economic use,*[3] I followed in part the relationships proposed by Schubert. In the last year or more it has been possible to study abundant material of some of these rare genera and to gain a much more adequate knowledge of them. Schubert's work was based on published figures and descriptions rather than on an actual study of specimens. I have now been able to study all of these genera from suites of specimens, and some changes in the relationships as given by Schubert are inevitable.

The genus *Chrysalidina* d'Orbigny is monotypic, the Cretaceous species *C. gradata* d'Orbigny being the only one known, as *C. dimorpha* H. B. Brady was made the type of a new genus *Chrysalidinella* by Schubert. At the École des Mines in Paris, I was enabled through the kindness of Dr. H. Douvillé to examine a series of *Chrysalidina gradata* d'Orbigny. The wall of these specimens is arenaceous and the genus should be placed in the Verneuilinidae as a derivative from *Verneuilina,* the position indicated for it by Schubert. *Chrysalidina* is to be distinguished from *Verneuilina* by the numerous rounded perforations of the apertural wall instead of the narrow single aperture of

[1] Received March 1, 1929.

[2] Neues Jahrb. Min. **1907**: 232–260.

[3] Spec. Publ. 1, Cushman Lab. Foram. Research, 1928.

Verneuilina. So far as we now know, it is an end form, as are so many of the genera which have developed sieve-like areas in the apertural face. It is possible that the peculiar form described by Brady as *Bigenerina robusta* has developed from such a triserial ancestry and has assumed a biserial and in some specimens a uniserial development in its later stages, with a sieve-like apertural face. That this form is related to the Palaeozoic *Climacammina* is very improbable.

In his grouping, Schubert derived his genera *Chrysalidinella* and *Chrysalogonium* from *Chrysalidina*. These are calcareous forms and do not belong with the arenaceous *Chrysalidina*, which, as just noted, belongs in the *Verneuilinidae*. The genus *Chrysalidinella* Schubert is monotypic, based on *Chrysalidina dimorpha* H. B. Brady, a species of the tropical seas, at the present time practically limited to the Indo-Pacific but in the Tertiary more widely distributed. This species, the types of which I saw in the Brady collection in London and Cambridge, is calcareous and the early stages are related to *Reussia*, as I have shown. I now have abundant material from the Indo-Pacific showing both the microspheric and megalospheric forms. *Chrysalidinella* is triserial like *Reussia* in its early stages, but becomes uniserial later and has the terminal face with numerous perforations. It is known from the Miocene to the Recent, whereas *Reussia* is known from the Cretaceous and is still living in tropical regions. *Reussia* developed from *Bulimina*, but is distinguished from typical forms of that genus by its triangular shape. The bulimine aperture is, however, still retained.

From what we know of the development of the Foraminifera, a form should occur in which the triserial condition is maintained, but the terminal face should show a sieve-like aperture. Such forms are now found to be abundant in the Indo-Pacific and two new species are figured here from off Fiji. These may be referred to the genus *Trimosina* Cushman, the genoholotype of which is the form figured by Millett as *Mimosina spinulosa* Millett, var. This specimen and others I was enabled to study in the Heron-Allen and Earland collection in the British Museum. In his genus *Mimosina*, Millett included several forms which need much more study. The typical *Mimosina* based on *M. hystrix* Millett I studied in London. The adult is biserial while the young stages, difficult to make out, seem in the microspheric form to be planispiral. Whether this genus is related to *Hantkenina*, as I have placed it, or is a biserial form related to *Trimosina* and *Reussia*, can only be determined by a study of much more material

than is now available. In *Trimosina perforata*, n. sp., figured here, there is a long slit-like aperture with the apertural face having a series of pores. This is different specifically from *Trimosina milletti* Cushman in which the perforate plate is not well developed. That the two are closely related however cannot be doubted when both are studied. Another species from off Fiji, figured here, is more primitive and shows the development from *Reussia* in even more marked fashion. These species of *Trimosina* fill in very well the stages from *Reussia* to *Chrysalidinella*.

The genus *Chrysalogonium* Schubert was based on *Nodosaria polystoma* Schwager, from the Pliocene of Kar Nicobar. It is nodosarian in form but the terminal face has a sieve-plate instead of the typical radiate aperture. This has been the only species known, but in the last year I have had material which can be referred to this genus from as far back as the Upper Cretaceous as well as from other ages, and it can be definitely stated that the genus does not belong, as indicated by Schubert, in the line with *Chrysalidinella* nor in this family. That genus will be discussed in another paper.

The relationships of these various genera therefore are as follows—*Chrysalidina* d'Orbigny is arenaceous and belongs in the Verneuilinidae derived directly from *Verneuilina*. *Chrysalogonium* Schubert is not derived, as Schubert indicated, from *Chrysalidinella*. *Reussia* is derived directly from *Bulimina*, and in turn gave rise to the triserial *Trimosina* Cushman with a sieve-plate and to the uniserial *Chrysalidinella* Schubert.

A description of two new species follows.

Trimosina perforata Cushman, n. sp.

Fig. 1 *a*, *b*

Test small, generally triangular in both side and end views, angles acute; chambers triserial throughout, rapidly increasing in size as added, the angles of the chambers usually protruding and early chambers sometimes twisted; sutures distinct, not depressed, slightly limbate; wall calcareous, finely perforate with coarser perforations along the borders near the sutures connecting with the interior by definite tubules, generally smooth, thin and nearly transparent; apertural face convex, with numerous ridges and irregular projections, aperture consisting of a long narrow opening connecting with the basal margin by a narrow slit at a sharp angle to the axis of the main opening, bordered by a distinct thickened lip, the apertural face with numerous irregularly rounded openings.

Length, 0.50 mm.; breadth, 0.35 mm.

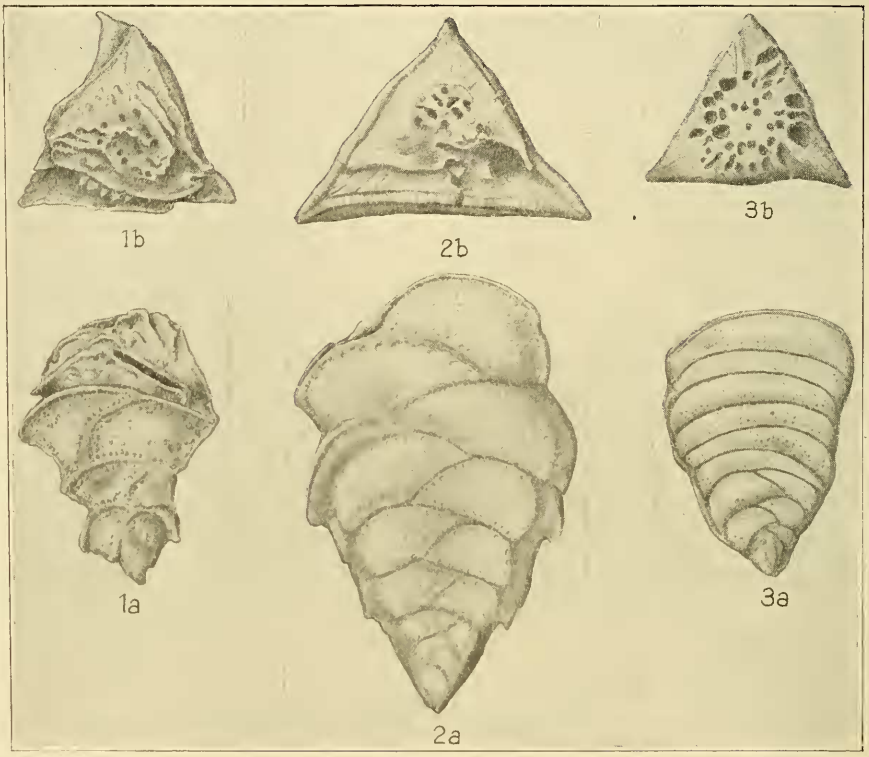
Holotype (Cushman Coll. No. 10363) from 40–50 fathoms off Fiji.

This species may be distinguished from the following by its very angular, coarser chambers, and the greater size of the sieve-plates.

Trimosina simplex Cushman, n. sp.

Fig. 2 *a, b*

Test of medium size, triangular in both side and end views, angles acute; chambers triserial throughout, uniformly increasing in size as added, angles of the chambers slightly spinose, the outer angle thickened, almost carinate; sutures distinct, not depressed, very slightly limbate, rather evenly curved;



Figs. 1 *a, b.—Trimosina perforata* Cushman, n. sp., *a*, front view; *b*, end view.
Figs. 2 *a, b.—Trimosina simplex* Cushman, n. sp., *a*, front view; *b*, end view.
Figs. 3 *a, b.—Chrysalidinella dimorpha* (H. B. Brady), *a*, front view; *b*, end view.
All figures × 75

wall calcareous, coarsely perforate, especially along the borders, smooth, fairly thick but translucent; apertural face slightly convex, fairly smooth, the aperture elongate without a lip, and with a few supplementary openings in the center of the terminal face.

Length, up to 1 mm.; breadth, 0.50 mm.

Holotype (Cushman Coll. No. 10365) from 40–50 fathoms off Fiji.

This species is a more primitive one than the preceding, and connects the other with *Reussia*.

In this same material from off Fiji at 40 to 50 fathoms, *Chrysalidinella dimorpha* (H. B. Brady) also occurs in the rather peculiar form shown here (Fig. 3 *a*, *b*). The sides are entire, the later chambers uniserial, and the terminal face with the apertures peculiarly arranged. There are probably several species of this genus which may be possible of separation.

Although all three of the species figured here occur together, they are distinguishable at a glance. The specimens of *Chrysalidinella* may be at once identified by the entire outline even before the uniserial chambers are noted. The two species of *Trimosina* are also strikingly different in general appearance. *T. simplex* has evenly placed and arranged chambers with small spinose projections extending backward at a decided angle, whereas *T. perforata* is a smaller but coarser form, the chambers relatively larger, the projections large and the whole test often twisted.

ZOOLOGY.—*The chromatropism of* Mermis subnigrescens, *a nemic parasite of grasshoppers.*[1] N. A. COBB, U. S. Department of Agriculture.

The adult female *Mermis subnigrescens*, when ripe for ovijection, has a way of moving her head in more or less horizontal curves;—her head, directed skyward, is waved in "circles," now clockwise, now the reverse. This seemingly purposeful behavior occurs when she emerges from the soil and while she is ascending the herbage to deposit her eggs. Inasmuch as the head of the egg-laying female,—unlike that of the *young* female as well as that of the male (neither of which ever quits the subterranean darkness),—contains *reddish transparent pigment* rather definitely distributed with reference to certain cephalic nerves, the question arose whether we do not have here a phototrope[2] and an

[1] Received March 12, 1929.

[2] It is suggested that the mechanisms through whose activation the responses of organisms termed *tropisms* find expression be called "tropes;"—"tropism" to be taken in almost any of its more or less well accepted meanings.

These meanings (interpretations of various investigators,—see Mast, 1915) vary all the way from (1) *"an inherent tendency to respond"* (Standard Dictionary), to (2) an *"irresistible" or "predictable" orientation as definite and mechanical as that of a magnetic needle;* but *whatever* the accepted interpretation, the *reaction-mechanism must always be present, and be a system* of intimately connected elements or organs, as is the digestive system, for instance, or the excretory system. Since we have for this system of intimately connected elements no inclusive single descriptive term, and since it is found highly convenient, or even necessary, for purposes of thought and discussion mentally to "isolate," and separately to denominate, the digestive system or enteron, and other systems, it is suggested that in behavior studies a like situation be met by a similar,